CIVIL ENGINEERING

1. A cantilever beam of span 4m and cross-sectional area 0.3m wide and 0.4m deep is subjected to a concentrated load of 10 kN at the free end. Neglecting self-weight, the maximum bending stress at a section 2m from the free end will be
   a. 20 kN/m^2
   b 2500 kN/m^2
   c. 4000kN/m^2
   d 5000kN/m^2

2. For the design of a simply supported RCC T-beam, the ratio of the effective span to the overall depth of the beam should not exceed
   a. 10
   b 20
   c. 30
   d. 40

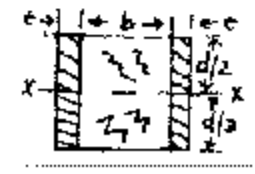
3. For a given stress, the ratio of the moment of resistance of a beam of square section when placed with one diagonal horizontal to the moment of resistance of the same beam when placed with two sides horizontal will be
   a. $\frac{1}{2}$
   b. 2
   c. 1.414
   d $\frac{1}{1.414}$

4. A beam of rectangular section 100 mm × 300 mm carries certain loads such that the Bending Moment at a section A is 'C' and at another section B it is (M + C).
   The distance between the sections A and B is 0.5m and there are no external loads acting between the two sections. If the value of C is 10,000 Nm. then the maximum shear stress is
   a. 1.5 MN/m^2
   b 1.0 MN/m^2
   c. 0.5 MN/m^2
   d. 0.25 MN/m^2

5. A cantilever is subjected to a uniformly distributed load W over its whole length 'L' and a concentrated upward force W at its free end. The deflection of the free end is
   a. Zero
   b $\frac{1}{384}\frac{WL^3}{EI}\downarrow$
   c. $\frac{5}{24}\frac{WL^3}{EI}\uparrow$
   d. $\frac{1}{2}\frac{WL^3}{EI}\downarrow$

6. A simply supported beam AB of span 'L' has a uniform cross- section throughout. It carries a central concentrated load W and another load which is uniformly distributed over the entire span, its total magnitude being W. The maximum deflection in the beam is
   a $\frac{9}{384}\frac{L^3}{EI}$
   b $\frac{13}{384}\frac{WL^3}{EI}$
   c $\frac{10}{384}\frac{WL^3}{EI}$
   d $\frac{15}{384}\frac{WL^3}{EI}$

7 Q 7. The given figure shows the section of a wooden beam stiffened with two steel plates each of thickness't securely fixed to the sides. The second moment of area of the fletched beam about the X-X axis is (given : d = overall depth of the beam. b = width of the wooden section and m = modular ratio of the moduli of elasticity of steel and wood)



a $\frac{bd^3}{12}$

b. $\frac{(b+2t)d^3}{12}$

c $(b+2mt)\frac{d^3}{12}$

d $\frac{bd^3}{12}-\frac{2t(md)^3}{12}$

8. In the case of a column of length 'l,' moment of inertia of cross-section 'I and Young's modulus of the material of the column 'E', being hinged at both ends, the buckling load, according to Euler's column theory, is given by

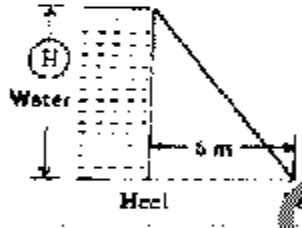
a $\frac{4\pi^2 EI}{l^2}$

b. $\frac{2\pi^2 EI}{l^2}$

c $\frac{\pi^2 EI}{l^2}$

d. $\frac{\pi^2 EI}{4l^2}$

9. For the retaining wall shown in the given figure, if the stress at the heel is zero, then the maximum storage 'H' will be



Specific gravity of the material of the wall = 2.25

a. 7.5m

b. 5m

c 4m

d. 3m

10 The kern of a circular cross-section of radius R is a concentric circular area with a radius of

a $\frac{R}{3}$

b $\frac{R}{4}$

c. $\frac{R}{6}$

d $\frac{R}{8}$

11 Q 11. In an otherwise symmetrical portal frame with one end fixed and the other end hinged, the hinge support sinks by an amount Δ . The fixed end bending moment induced at each end of the horizontal member of the frame due to the sinking of the support will be (given that L is the length of the member and EI is the flexural stiffness)

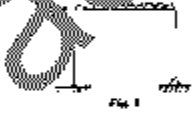
a. $\frac{3EI\Delta}{L^2}$

b. $\frac{4EI\Delta}{L^2}$

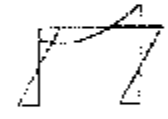
c. $\frac{2EI\Delta}{L^2}$

d. $\frac{6EI\Delta}{L^2}$

12 A loaded portal frame is shown in fig. I The profile of its Bending Moment diagram will be

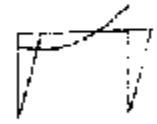


(a)

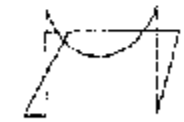


(b)

(c)



(d)



13 A 2-meter diameter water pipe is required to withstand a 200 meter head of water. Assuming the limiting tensile stress for the pipe material to be 200 kg/cm2, the minimum thickness of the material of the pipe to be used will have to be

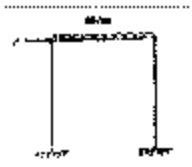
a. 5 cm

b. 10cm

c. 15cm

d. 20cm

14 The frame shown in the given figure has



a. One unknown reaction component
b. Two unknown reaction components
c. Three unknown reaction components
d. Six unknown reaction components

15 The absolute maximum Bending Moment in a simply supported beam of span 20 m due to a moving udl of 4 t/m spanning over 5 m is

a. 87.5 t-m at the support
b. 87.5 t-m near the midpoint
c. 3.5 t-m at the midpoint
d. 87.5 t-m at the midpoint

16. The plastic section modulus of a rectangular section of width 100 mm and depth 12 mm is

a. 1000 mm^3
b. 1800 mm^3
c. 2400 mm^3
d. 3600 mm^3

17 Consider the following statements

Clays which exhibit high activity

1 Contain montmorillonite.
2 Contain kaolinite
3. Have high silt content
4 Have a high plasticity index
5. Have a low plasticity index. Of these statements

a. 1, 3 and 5 are correct
b. 2, 3 and 5 are correct
c. 2 and 4 are correct
d. 1 and 4 are correct

18. In a compaction test on a soil sample, if the Compaction energy is decreased

(γ_d = maximum dry density,

OMC = optimum moisture continent)

a γ_d will increase with increase in OMC
b γ_d will decrease with increase in OMC
c. γ_d will decrease with decrease in OMC
d. γ_d will increase with decrease in OMC

19. A sample of clay and a sample of sand have the same specific gravity and void ratio. Their perm abilities would differ because

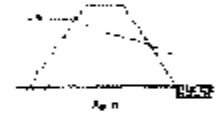
a. Their porosities would be different
b Their degrees of saturation would be different
c Their densities would be different
d. The size ranges of their void would be different

20 During seepage through an earth dam, the direction of seepage is

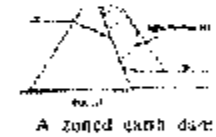
a Parallel to the equipotential lines
b. Perpendicular to the stream lines
c Perpendicular to the equipotent lines
d. Along the direction of gravity

21 Paretic lines for different types of drainage/filter arrangements are shown in figures I, II & III

Homogeneous earth dam with chimney drain



Homogeneous earth dam when the downstream slope forms its own a medium for discharge and the horizontal filter is outside the toe



A zoned earth dam

The paretic line is correctly shown in figure (s)

a. I and II
b. I and III
c. II alone
d. II and III

22 Given that the effective angle of internal friction of a soil is 10°, the angle between the failure plane and the major principle plan will be

a. 17.5°
b. 27.5°
c. 40°
d. 50°

23 In which one of the following situations would one use shear parameters obtained from consolidated quick test with pore pressure measurements?

a Foundation on salty sands

b. Excavation in saturated clays
c. Previous dams and slop stability
d. Determination of earth pressures in saturated clays

24. Consider the following limitations:
1. Can be performed only on purely cohesion less soils
2. Plane of failure is predetermined
3. There is virtually no control on drainage
4. Non-uniform distribution of stresses
5. Principal stresses in the sample cannot be determined

The limitations inherent in direct shear test include
a. 1,2 and 3
b. 2,3 and 4
c. 3,4 and 5
d. 1,2 and 5

25. Consider the following assumptions
1. Failure occurs on a plane surface.
2. Wall is smooth but not necessarily vertical.
3. Failure wedge is a rigid body. Coulomb's theory of earth pressure is based on assumptions
a. 1, 2 and 3
b. 1 and 2
c. 1 and 3
d. 2 and 3

26. Match List I (field problems) with List II (type of laboratory shear test to be carried out) and select the correct answer by using the codes given below the lists:

List I
A. Stability of a clay foundation of an embankment whose rate of construction is such that some consolidation occurs during construction
B. Initial stability of footing on saturated clay
C. Long-term stability of a slope in stiff fissured clay.
D. Foundation on soft marine clay deposited.

List II
1. Untrained trail test
2. Drained triaxial test
3. Consolidated untrained triaxial test
4. Quick vane shear test

Codes:

	A	B	C	D
a.	1	3	2	4
b.	1	3	4	2
c.	3	1	2	4
d.	3	1	4	2

27. For stability analysis of slopes of purely cohesive soils, the critical centre is taken to lie at the intersection of
a. The perpendicular bisector of the slope and they locus of the centre
b. The perpendicular drawn at one-third slope from the toe and the locus of the centre
c. The perpendicular drawn at two-third slope from the toe and the locus of the centre
d. Directional angles

28. In a typical deposit of submerged soil, the approximate depth at which the inter-granular pressure is equal to 50 kN m^2 is
a. 2.5m
b. 5m
c. 7.5m
d. 10 m

29. In a saturated clay layer undergoing consolidation with single drainage at its top, the pore water pressure would be the maximum at its
a. Top
b. Middle
c. Bottom
d. Top as well as the bottom

30. A saturated clay stratum of thickness 10m bounded on top and bottom by medium coarse sand layers, has a coefficient of consolidation of 0.002 cm^2/s. If this stratum is subjected to loading, it is likely that it would undergo 50% of its primary consolidation in
a. 1136 days
b. 227 days
c. 284 days
d. 568 days

31. A circular area of radius 'R' on the surface of a semi- infinite soil mass is uniformly loaded with a loading intensity of q. The

vertical stress a directly below its centre at a depth σ_z is given by

a. $\frac{q}{2\pi}\left[\frac{1}{1+\left(\frac{R^2}{z}\right)}\right]^2$

b. $q\left[1-\frac{1}{\left(\frac{R^2}{z}\right)}\right]^{3/2}$

c. $\frac{3q}{2\pi z^2}\left[\frac{1}{1+\left(\frac{R}{z}\right)^2}\right]^{5/2}$

d. $\frac{q}{2\pi z}\left[\frac{1}{1+\left(\frac{R}{z}\right)^2}\right]^{3/2}$

32. A normally consolidated clay layer settles by 25 mm when the effective stress is increased from 15 kPa to 30 kPa. If the effective stress is later increased further from 30 kPa to 60 kPa, then the additional settlement would be

a. 25 mm
b. 50 mm
c. 75 mm
d. 100 mm

33. Match List I (Site condition) with List II (Type of foundation) for a heavy rigid structure and select the correct answer by using the codes given below the lists

List I

A. Thick stiff clay
B. Soft clay overlying firm strata at moderate depth
C. Thick soft clayey strata
D. Firm thin strata over

List II

1. End bearing piles
2. Raft/Friction piles
3. Friction piles/raft
4. Footings

	A	B	C	D
a.	1	4	2	3
b.	4	1	3	2
c.	4	1	2	3
d.	1	4	3	2

34. The stress distribution at a depth beneath a loaded area is determined using Newmarks influence chart which indicates an influence value of 0.005. The number of segments covered by the loaded area in the chart is 20 and the intensity of loading on the area is 10 T/m2. The intensity of stress distribution at that depth is

a. 1 T/m^2
b. 2 T/m^2
c. 5 T/m^2
d. 10 T/m^2

35. Consider the following field tests

1. Vertical pile load test
2. Cyclic pile load test
3. Lateral pile load test
4. Instrumented test pile

While estimating the load carrying capacity of a pile, the tests that can be used for separating the skin resistance from point resistance, would include

a. 1 and 3
b. 1 and 4
c. 2 and 3
d. 2 and 4

36. Consider the following statements regarding settlement of foundations:

1. Differential settlement of foundation leads to structural damage to the superstructure.
2. In non-cohesive soils, the major component of settlement is due to consolidation.
3. Lowering of ground water table contributes to settlement of foundations.

Of these statements

a. 1 and 2 are correct
b. 1 and 3 are correct
c. 2 and 3 are correct
d. 1, 2 and 3 are correct

37. Consider the following steps

1. Driving sheet piles surrounding a vibration-receiving structure.

2. Digging a trench around a source of vibration.
3. Placing rubber mountings between a machine causing vibration and its base.

Active isolation of vibration can be achieved by

a. 1 and 2
b. 1 and 3
c. 2 and 3
d. 3 alone

38. The upper limit of area ratio for which the amount of disturbance of soil sample can be considered to be small is

a. 10%
b. 15%
c. 20%
d. 25%

39. Consider the following types of soil tests

1. California bearing ratio
2. Consolidation
3. Unconfined compression

The soil tests required to be done in the case of undisturbed samples include

a. 1, 2 and 3
b. 1 and 2
c. 1 and 3
d. 2 and 3

40. Boring method is to be chosen depending upon the type of exploratory strata. In this context, match List I with List II and select the correct answer using the codes given below the lists:

List I

A. Auger boring
B. Wash boring
C. Percussion drilling
D. Rotary drilling

List II

1. Partly saturated sands, silts and medium to stiff cohesive soils
2. All types of soils and rocks excepts in stony or perous soils and fissured rocks
3. Practically all types of soils except hard and cemented soil or rock
4. All types of soils and rocks. Difficult in loose sands and soft sticky clays

	A	B	C	D
a.	1	4	3	2
b.	1	3	4	2
c.	2	4	3	1
d.	2	3	4	1

41. Match List I (fluid type) with List II (Example) and select the correct answer by using the codes given below the lists:

List I

A. Newtonian
B. Ideal plastic
C. Thyrotrophic
D. Pseudo plastic

List II

1. Blood
2. Printer's ink
3. Oil paint
4. Water

Codes:

	A	B	C	D
a.	3	4	1	2
b.	4	3	2	1
c.	4	3	1	2
d.	3	4	2	1

42. In order that a droplet of water at 20°C (σ =0.0728 N/m) has an internal pressure 1kPa greater than that outside it, its diameter should be nearly

a. 0.15 mm
b. 0.3 mm
c. 0.6 mm
d. 1.2 mm

43. Glycerin (specific weight 1260 kg/m3, dynamic viscosity 8.00 × 10 kg-s/m^2) is spread freely to a thickness of 1 mm between a bottom stationary plate and a top movable plate of 10 cm2 area. The top plate is to be moved at a uniform speed of 1 m/s. The force to be exerted on the top plate is

a. 1.6 kg
b. 0.8 kg
c. 0.16kg
d. 0.08kg

44. A 3 m wide, 2.5 deep, 10m long tank, open at the top, has oil standing to 1 m depth. The maximum horizontal acceleration that can be given to the tank without spilling the oil will nearly be

a. 0.10g
b. 0.20g
c. 0.25g
d. 0.31g

45. A hollow cylinder made of wood (sp. gr. 0.8) has an external diameter of 1.0 m and an internal diameter of 0.6 m. It floats in water with its axis vertical and is in stable equilibrium. This is possible only when the length of the cylinder is equal to or less than
a. 0.72m
b. 0.95m
c. 1.08m
d. 1.20m

46. In a horizontally held injection syringe, the piston of 0.2 cm^2 cross-sectional area is pushed at a constant speed of 1.0 cm/s to eject water into the atmosphere through a hypodermic needle of 0.07 mm^2 cross-sectional area while rinsing. Neglecting losses, the force required to move the piston is nearly
a. 6 kg
b. 6×10^{-3} kg
c. 6×10^{-5} kg
d. 6×10^{-7} kg

47. If a sluice gate produces a change in the depth of water from 3.0 m to 0.5 m, then the force on the gate is about
a. 9.5 kN/m
b. 19.0 kN/m
c. 38.0 kN/m
d. 76.0 kN/m

48. Consider the following types of weirs
1. Proportional weir
2. Cipolletti weir
3. Parabolic weir
4. Rectangular weir (without end contraction)

All these weirs have varying values of exponent in the formula $Q = KH^n$. The correct sequence of these weirs in increasing order of the value of n is
a. 2,1,3,4
b. 2,1,4,3
c. 1,2,3,4
d. 1,2,4,3

49. A velocity field with no components in the y and z directions is given by
$V = 2xy + t^2$.
The acceleration along the x-direction at a point (3,1, 2). At time 2, is
a. 8 units
b. 16 units
c. 28 units
d. 36 units

50. The acceleration components of a fluid particle are denoted as
1. Local tangential acceleration.
2. Convective tangential acceleration.
3. Local normal acceleration.
4. Convective normal acceleration.

In a curved nozzle fitted to the end of a straight pipeline carrying water under variable head, the acceleration components that are present would include
a. 1 and 2
b. 3 and 4
c. 1, 2 and 4
d. 1, 2, 3 and 4

51. A free vortex formed from originally still water, say, as when draining still water in a flat-bottomed basin by suddenly pulling the stopper at the bottom on the drain hole, will be
a. Clockwise in the northern as well as the southern hemispheres
b. Anticlockwise in the northern as well as the southern hemispheres
c. Anticlockwise in the nrishear and clockwise in the southern hemisphere
d. Clockwise in the northern hemisphere and anticlockwise in the southern hemisphere

52. Match List I with List II and select the correct answer using the codes given below the lists:

List I (Fluid action)
A. Swinging of a cricket ball
B. Flow past an infinite cylinder
C. Flow past an aerofoil
D. Boundary Layer separation

List II (Phenomenon associated with Fluid action)
1. Darcy's law
2. Wake

3. Karman Vortex Street
4. Magnus effect

Codes:

	A	B	C	D
a.	3	4	1	2
b.	2	3	4	1
c.	3	4	2	1
d.	4	3	2	1

53. The following statements relate to a laminar flow

1. Laminar flow is rotational.
2. In laminar flo4 the loss of head is proportional to the square of the velocity.
3. In laminar flow the loss of head is proportional to the first power of viscosity.
4. In laminar flow the velocity is constant over the cross section.
5. Other quantities remaining the same, increase in diameter will increase the Reynolds number in laminar flow.

Of these statements

a. 1, 2 and 4 are correct
b. 1, 3 and 4 are correct
c. 1, 3 and 5 are correct
d. 2, 3 and 5 are correct

54. Oil of relative density 0.80 issues from a 50 mm diameter orifice under a pressure of 100 kN/m^2 (gauge). If the coefficient of velocity is taken as unity, the issuing velocity will nearly be

a. 1 m/s
b. 13 m/s
c. 16 m/s
d. 20 m/s

55. Which one of the following groups constitutes a set of parameters of identical dimensions?

a. Velocity potential, stream function, vorticity
b. Power, torque, bending moment
c. Relative roughness, friction factor, sub layer thickness
d. Rate of angular deformation, velocity gradient, speed in rpm

56. Vorticity in the z-direction is given by

a. $\left(\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}\right)$
b. $\left(\frac{\partial u}{\partial x}-\frac{\partial v}{\partial y}\right)$
c. $\left(\frac{\partial v}{\partial x}+\frac{\partial u}{\partial y}\right)$
d. $\left(\frac{\partial v}{\partial x}-\frac{\partial u}{\partial y}\right)$

57. In a two- dimensional boundary layer over a flat surface

a. The longitudinal pressure gradient is important and the transverse pressure gradient can be neglected
b. The transverse pressure gradient is important and the longitudinal pressure gradient can be neglected
c. Both the longitudinal and transverse pressure gradients can be neglected
d. Both the longitudinal and transverse pressure gradients- are important

58. The optimum efficiency of a lifting vane is limited by the

a. Onset of stall
b. Separation from the trailing edge
c. Separation from the leading edge
d. More rapid increase of C_l that of C_L

59. Given that g = acceleration due to gravity and R= hydraulic mean depth, the Darcy-Weisbach friction factor is related to Manning's rugosity coefficient n as

a. $\frac{8gn^2}{R^{1/3}}$
b. $\frac{gn^2}{8R^{1/3}}$
c. $\frac{64ng}{R^{1/3}}$
d. $\frac{R^{1/3}}{8^{1/4}}$

60. A surge tank is provided in a hydropower scheme to

a. Provide additional storage close to the penstock
b. Take care of change of slope, alignment
c. Reduce the pressures under transient conditions

d. Provide convenient overspill

61. Match List I (methods) with List II (suitability for assessing mean flow velocity) and select the correct answer by using the codes given below the lists

List I

A. Salt diffusion method

B. Surface float method

C. A set of velocity rods

D. Current meters

List II

1. Natural streams with uneven beds
2. Straight channels with irregular cross-sections
3. Flow in tortuous channel
4. Wide rectangular channel

Codes:

	A	B	C	D
a.	3	1	2	4
b.	2	4	1	3
c.	2	3	4	1
d.	3	4	2	1

62. In a wide rectangular channel, the small surface waves caused due to disturbance by a suddenly thrown heavily weighted piece of wood, thrown parallel to the cross-section, were seen to move at 1.2 m/s downstream and 1.4 m/s upstream (with reference to the banks). The velocity of flow and the mean flow velocity are, respectively, nearly

a. 0.2 m and 1.4 m/s

b. 0.3 m and 1.4 m/s

c. 0.2m and 1.3 m/s

d. 0.3m and 1.3 m/s

63. Consider that $\frac{p}{\rho^{\kappa}}$ = constant expresses an isentropic process, which one of the following is not a representation of the speed of a sound wave?

(Symbols have the usual meaning)

a. $\sqrt{kgRT}$

b. $\sqrt{\frac{dp}{d\rho}}$

c. $\sqrt{\frac{k}{\rho}}$

d. $\sqrt{\frac{p}{\rho}}$

64. Flow of air can be considered to be incompressible within 1% error if the Mach Number of flow is less than

a. 0.1

b. 0.2

c. 0.4

d. 0.6

65. The smallest scale adopted for topographical surveys is

a. 1: 25,000

b. 1: 50,000

c. 1: 2,50,000

d. 1: 5,00,000

66. In an external focusing tachometer, the fixed interval between the staid hairs is 5 mm, the focal length of the objective is 25 cm and the distance of the vertical axis of the instrument from the optical centre of the objective is 15 cm. The constants of the tachometer are

a. 50; 0.40 m

b. 50; 0.25 m

c. 00; 0.40m

d. 30; 0.10 m

67. An imaginary line passing through the optical centre of the objective and the optical centre of the eye-piece in the telescope of a surveying instrument is called the

a. Horizontal axis

b. Line of collimation

c. Optical axis of the telescope

d. Reference axis

68. The ratio of the "standard error of a single observation of unit weight" to the standard error of the arithmetic mean of 'n' observations, all of unit weight, will be

a. (1/n)

b. N^n

c. $\sqrt{n}$

d. $3\sqrt{n}$

69. In a third order traverse, if the standard error of ± 3" is assigned to each of the four sources of errors, namely (i) reading the vernier, (ii) non-adjustment of transit, (iii) sighting, and (iv) setting over the station,

then the total standard error of the work would be

a. ± 3"

b. ± 6"

c. ± 6.92"

d. ± 12"

70. During the measurement of a line by chain or tape in slopes, if the length of the line is 'l' and the height difference between the ends of the line is h, then the correction to the measured length is more than $\frac{h^2}{2l}$ by

a. Zero

b. $-\frac{h^4}{8l^3}$

c. $-\frac{h^4}{4l^2}$

d. $-\frac{h^3}{2l^2}$

71. In an old map, line PQ was drawn to a magnetic bearing of 6° 323, the magnetic declination at that time being 1° East. The present magnetic declination is 9°42 East The magnetic bearing toe which the line is set at present is

a. 357°50

b. 356°50

c. 3°10'

d. 2°10'

72. The distance between two bench marks is 1000 m. If during leveling, the total error due to collimation, curvature and refraction is found to be – 0.120 m, then the magnitude of the collimation error is

a. 0.0052 m

b. 0.0[illegible] m

c. 0.12 m

d. 0.673 m

73. When the bubble of a level tube was moved by 10 divisions, the change in staff intercept was 0.05m If the distance between the staff and the instrument was 100 m, then the sensitiveness of the bubble tube is given by

a. 1.03 sec of arc

b. 10.3 sec of arc

c. 20.6 sec of arc

d. 103 sec of arc

74. In trigonometric leveling, if the horizontal distance between the instrument and the object is 3088m, the coefficient of refraction is 0.07 and R sin 1" 30.88 m. then the refraction correction in angular measure would be

a. 0.07"

b. 0.70"

c. 7.0"

d. 1'10"

75. In the given formula form[illegible], 'L' is the length of the base line split into 'n' equal segments ends of length 'd' O_1, O_2 ....., O_{n+1} are the ordinates at the sequential ends of the segments and M_1, M_2.....M_n are the mid-ordinates of successive segments. Which of the following pairs of rule and the formulae for computation of the area 'A' and 'g on the base line are correctly matched?

1. Mid ordinate rule ..... $A = d\left[\frac{O_1 + O_2 + \ldots O_n}{n}\right] \times L$

2. Average ordinate Rule ..... $A = \frac{L}{n}\left[M_1 - M_2 - \ldots - M_n\right]$

3. Trapezoidal rule ..... $A = d\left[\left(\frac{O_1 + O_{n+1}}{2}\right) - O_2 + O_3 + \ldots + O_n\right]$

4. Simpsons's ..... $A = \frac{d}{3}\left[O_1 + O_{n+1} - 4(O_2 - O_4 \ldots) - 2(O_3 - O_5 - \ldots O_n)\right]$

Select the correct answer using the codes given below:

Codes:

a. 1 and 2

b. 1 and 3

c. 3 and 4

d. 2 and 4

76. A circle of radius 7m has a standard error of 0.02m on the radius. The standard error of its area is

a. 0.04 m^2

b. 0.14 m^2

c. 0.28 m^2

d. 0.88 m^2

77. Match List I (source of errors is the ocolite observation) with List II (elimination

process) and select the correct answer by using the codes given below the lists

List I

A. Eccentricity between inner and outer axes

B. Imperfect graduations of the horizontal scale

C. Imperfect adjustments of plate level

D. Line of collimation not being perpendicular to the horizontal axis

List II

1. Capstan headed screw adjustment
2. Double centering process
3. Taking the mean of two vernier readings
4. Taking observations over different portions of the horizontal scale

Codes:

	A	B	C	D
a.	1	4	3	2
b.	3	4	1	2
c.	3	2	1	4
d.	1	2	3	4

78. Fore bearings (FB) and back bearings (BB) of lines PQ and QR have been measured as:

Line	FB	BB
PQ	59°0'	235°0'
QR	125°30'	309°0'

The correct value of the interior angle PQR will be

a. 105° 00'
b. 109° 30'
c. 2500 00'
d. 255° 00'

79. The fix of a plane table from three known points is good if

a. The middle station is the nearest
b. The middle station is farther than the other two stations
c. Either of the extreme stations is the nearest
d. The middle station is close to the great circle

80. A summit station is close to the great circle cent grade with –3 per cent grade. If the tangents intersect at an elevation of 60m and the rate of change of grade is –1 percent per 100m, then the elevation of the beginning point of the vertical curve will be

a. 58.5 m
b. 57.5 m
c. 55.0 m
d. 52.5m

81. If the azimuths of the two tangents to a circular curve of radius 100 m are due north and due east, then the area bounded by the two tangents and the circular curve will be

a. 7857 sq.m
b. 5000 sq.m
c. 3143 sq.m
d. 2143 sq.m

82. Consider the following statements associated with the laws of weights in the theory of errors

1. If an equation is multiplied by its own weight, then the weight of the resulting equation is equal to the reciprocal of the weight of that equation
2. The weight of the algebraic sum of two or more quantities is equal to the reciprocal of the sum of the individual weights.
3. If the quantity of a given weight is multiplied by a factor, then the weight of the result is obtained by dividing its given weight by the square root of that factor.
4. if the quantity of a given weight is divide by a factor, then the weight of the result is obtained by multiplying its given weight by the square of that factor.

Of these statements

a. 1 and 4 are correct
b. 2 and 3 are correct
c. 3 and 4 are correct
d. 1 and 3 are correct

83. In the tangential method of tachometry, following notations have been used

α_1 = angle of elevation corresponding to upper vane

α_2 = angle of elevation corresponding to lower vane

S = distance between the vanes-staff intercept

D horizontal distance
V = vertical distance

In this context, match List I (Quantity to computed under the given conditions) with List II (Equation to be used) and select the correct answer using the codes given below the lists:

List I

A. 'D' when both the angles are angles of elevation

B. 'V' when both the angles are angles of elevation

C. 'D' when one angle is angle of elevation and the other that of depression

D. 'V' when both angles are angles of depression

List II

1. $\frac{S \tan \alpha_2}{\tan \alpha_2 \quad \tan \alpha_2}$

2. $\frac{S}{\tan \alpha_1 \quad \tan \alpha_2}$

3. $\frac{S \tan \alpha_2}{\tan \alpha_1 - \tan \alpha_2}$

4. $\frac{S}{\tan \alpha_1 \quad \tan \alpha_3}$

Codes:

	A	B	C	D
a.	3	4	1	2
b.	4	3	1	2
c.	3	4	1	2
d.	4	3	2	1

84. Consider the following properties

1. The sum of the three sides is always greater than the circumference of the great circle.
2. The sum of the three angles is less than six right angles and greater than two right angles.
3. The sum of two sides is greater than the third side
4. The smaller angle is opposite the smaller side and vice versa.

The properties of spherical triangles would include

a. 1, 2 and 3

b. 2, 3 and 4

c. 1, 2 and 4

d. 1, 3 and 4

85. A 3000m long line lying at an elevation of 450 m measures 10 cm on a vertical photograph. The focal length of the camera is 21 cm. The scale of the photograph for the area having an elevation of 1000 m will be

a. 1:27381

b. 1:25008

c. 1: 20606

d. 1: 30421

86. Which one of the following statements about photogram metric surveying is correct?

The relief displacement

a. Decreases with increase in flying height

b. Is negative for a point above datum

c. Decreases as the distance of the object from the principal point increases

d. Of the point is not affected by the tilt of the photograph

87. **Assertion (A):** The ordinates of the funicular polygon of a given loading on a simple beam measure the deflection of the beam are various sections.

Reason (R): The deflection of a simple beam at any section is proportional to the BM of the conjugate beam at that section.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is not a correct explanation of A

c. A is true but R is false

d. A is false but R is true

88. **Assertion (A):** When a particle resting on a rough table is taken around a closed path on the table, the total work done on the particle is zero.

Reason (R) If the work done in moving a particle along a closed path in a force field is zero then the force field is conservative.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is not a correct explanation of A

c. A is true but R is false

d. A is false but R is true

89. **Assertion (A):** The ultimate load of a structure made of ductile material,

subjected to reversible repeating loads and plastic deformation. is lowered with each reversal of load.

Reason (R): When subjected to repeated reversal of loads and plastic deformation, the structure made of a ductile material accumulates residual strains.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

90. **Assertion (A):** When a saturated soil mass is subjected to consolidation. its volume at any instant is related to the total stress.

Reason (R): Total stress is equal to the sum of the effective stress and pore water pressure.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

91. **Assertion (A):** Highly plastic swelli[illegible] type of clay can be best stabilized by [illegible] lime as admixture.

Reason (R): Absorption of wat[illegible] by lime in the soil improves its shear [illegible]

a. Both A and R are [illegible] and R is the correct explanation [illegible]
b. Both A and R are tru[illegible] but R is not a correct explanation of A
c. A is true but R is false
d. A is false [illegible] R is true

92. **Assertion (A):** Dynamic formulae are not recommended for computing allowable loads on piles driven into cohesive soils.

Reason (R): In cohesive soils, the resistance to pile driving increases due to any sudden increase in pressure in the pore water.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

93. **Assertion (A):** The discharge (Q) thought triangular weir is given by $Q = \frac{18}{15} C_d \sqrt{2g} h^{5/2} \tan\frac{\theta}{2}$ where C_d is the coefficient of discharge. h is the head of flow θ is the apex angle of the weir and g is acceleration due to gravity.

Reason (R): The cross-sectional area of flow in a triangular weir is $h^2 \tan\frac{\theta}{2}$ and the average velocity is $\frac{8}{15} C_d \sqrt{2gh}$.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

94. **Assertion (A):** When both gravitational and viscous forces are predominant in a model, scale ratio can be chose at will.

Reason (R): With both gravitational and viscous forces being predominant, scale ratio depends upon the kinematics viscosity of the fluids.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

95. **Assertion (A):** If an aero plane attempts to rise at a very steep angle, a condition termed as stall is experienced and there is a sudden drop in the lift force on the wings. Such a situation often results in the sudden plunging of the aero plane.

Reason (R): At large angles of attack, the boundary layer separates from the lower surface and a vacuum develops below the wings' lower surface.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

96. **Assertion (A):** Any discharge will flow as critical in a wide rectangular channel whose bed slope is 1 in [illegible]g.

Reason (R): The critical depth of flow through a wide rectangular channel is $(q^2/g)^{1/3}$

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is not a correct explanation of A

c. A is true but R is false

d. A is false but R is true

97. **Assertion (A):** The meridian distance of any line is equal to the meridian distance of its mid-point

Reason (R): The meridian distance of any line is equal to the meridian distance of the preceding line plus half the departure of the preceding line plus half the departure of the line itself.

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is not a correct explanation of A

c. A is true but R is false

d. A is false but R is true

98. **Assertion (A):** The rate of increase of curvature along the transition curve should be equal to the rate of increase of super elevation

Reason (R): The length of the transition curve should be fixed in such a manner that full super elevation is attained at the junction with the circular curve

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is not a correct explanation of A

c. A is true but R is false

d. A is false but R is true

99. **Assertion (A):** In hydrographic surveying, the tidal datum is the level of the water surface below which the tide rarely falls.

Reason (R): To determine the reduced level of the bed of the water body accurately, it is essential that one determines the reduced level of the water surface at the time of sounding by the tide gauge

a. Both A and R are true and R is the correct explanation of A

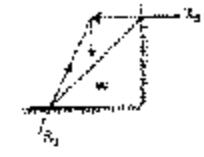
b. Both A and R are true but R is not a correct explanation of A

c. A is true but R is false

d. A is false but R is true

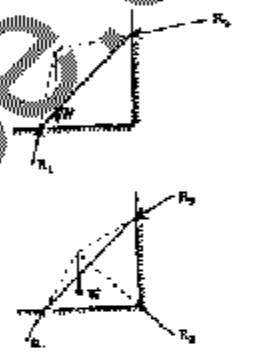
100. A ladder is not placed on the floor leaning against a wall the floor nor is the wall smooth. If W is the weight of the ladder and R_1, R_2 and R_3 are the reactions, then the free-body diagram will be as in

(a)



(b)

(c)



101. A square framework formed on uniform heavy rods of equal weight joined together is hung by one corner. A weight W is suspected from each of the three lower corners and the shape of the square is preserved with the help of a light rod along the horizontal diagonal. The thrust of the light rod is

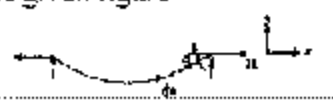
a. 2W

b. 3W

c. 4W

d. 6W

102. Which one of the following is the correct differential equation of the shape of the cable (similar to electrical cables) of unit weight 'q' with small slopes, as shown in the given figure?



a. $\frac{d^2y}{dx^2} + \frac{q}{H}\frac{ds}{dx}$

b. $\frac{d^2y}{dx^2} - \frac{q}{H}$

c. $\frac{d^2y}{dx^2} = \frac{q}{G}\sin\theta$

d. $\frac{d^2y}{dx^2} = \frac{q}{H}\cos\theta$

103. The effort 'P' to be applied horizontally to pull a weight 'W' on a plane inclined at an angle α with the horizontal is given by ($\tan\phi$ is the coefficient of friction)

a. $P = W\tan(\alpha + \phi)$

b. $P = W\tan(\alpha - \phi)$

c. $P = \frac{W\sin(\alpha - \phi)}{\cos(\alpha - \phi)}$

d. $P = \frac{W\sin(\alpha - \phi)}{\cos(\alpha - \phi)}$

104. The quantities given in List I and List II correspond to a projectile on plane horizontal ground with an initial velocity 'u' and an angle of projection α with the horizontal. Match List I with List II and select the correct answer using the codes given below the lists:

List I

A. Maximum height

B. Maximum range

C. Time taken to reach the maximum height

D. Time of flight

List II

1. $\frac{u}{g}\sin\alpha$

2. $\frac{2u}{g}\sin\alpha$

3. $\frac{u^2\sin^2\alpha}{2g}$

4. $\frac{u^2\sin 2\alpha}{g}$

5. $\frac{u^2\sin^2\alpha}{2g}$

Codes:

	A	B	C	D
a.	4	3	2	1
b.	3	4	1	2
c.	5	3	2	1
d.	5	4	1	2

105. A particle is moving on a plane curve with velocity $\overline{V}$'s' is the arc length of the particle from a fixed point on the curve and (r, θ) its position coordinates at time C. The transverse component of the acceleration of the particle is given by

a. $\frac{d^2r}{dt^2} - r\frac{d\theta}{dt}$

b. $r\frac{d^2\theta}{dt^2} + 2\frac{dr}{dt}\frac{d\theta}{dt}$

c. $\frac{d\overline{v}}{dt}$

d. $\overline{v}\frac{d\theta}{ds}$

106. A car of mass 1200 kg is moving with a constant velocity of 60 kmph. When the brakes causing 4.5 kN force are applied the distance traveled before the car comes to rest will be

(g = sum = g = 9.8m1s2)

a. 77.03 m

b. 73.03 m

c. zero

d. 76.03 m

107. Two spheres of mass 15 kg and 20 kg, move along a straight line in the same direction with velocities of 20 m/s and 5m/s, respectively. If the coefficient of restitution is 0.7, then the velocity of the 15 kg mass after collision will be

a. 5.43 m/s

b. 15.93 m/s

c. 18.72m/s

d. 16.16 m/s

108. A particle moves with simple harmonic motion, if its acceleration at distance 'D' from the equilibrium position is 'A, then the period of the motion is given by

a. $2\pi\sqrt{AD}$

b. $\frac{2\pi}{\sqrt{AD}}$

c. $2\pi\sqrt{\frac{A}{D}}$

d. $2\pi\sqrt{\frac{D}{A}}$

109. A bullet of mass 0.01 kg moving with a velocity of 401 m/s strikes a block of mass

4 kg which is free to move in the direction of the bullet , and gets embedded in it The overall loss Kinetic energy is

a. 80.2 Nm

b. 401 Nm

c. 802 Nm

d. 1604 Nm

110 A uniform circular disc of mass 5kg and radius 3cm is revolving uniformly at 60 rpm about an axis passing through a point on the rim perpendicular to the plane of the disc The kinetic energy of the disc is

a. 13.5 Nm

b. $\frac{27\pi^2}{2000}$ Nm

c. 27000 Nm

d. 15π Nm

111 In a plane strain problem, the tensile stresses along two mutually perpendicular rectangular coordinate axes x and y are σ_x and σ_y respectively with $\sigma_x > \sigma_y$ and there are no shearing stresses The Poisson's ratio is γ, the stress along the third rectangular co-ordinate axis z will be

a. $\gamma(\sigma_x - \sigma_y)$

b $-\gamma(\sigma_x - \sigma_y)$

c $\gamma(\sigma_x - \sigma_y)$

d $\gamma(\sigma_x \quad \sigma_y)$

112 A bar of elastic material is subjected to a direct compressive stress σ_1 in the longitudinal direction Suitable lateral compressive stress σ_2 is applied along each of the other two lateral directions to limit the strain in each of the lateral directions to half the magnitude of what it would be under σ_1 acting alone If μ is the Poisson's ratio of the material, then the magnetite of σ_2 is

a. $\frac{2(1-\mu)}{\mu}\sigma$.

b $\frac{1}{2}\frac{(1-\mu)}{\mu}\sigma$.

c $\frac{1}{2}\frac{\mu}{(1-\mu)}\sigma$

d. $\frac{1}{2}\frac{\mu}{(1-\mu^2)}\sigma$.

113 In a particular material, if the modulus of rigidity is equal to the bulk modulus, then the poisson's ratio will be

a. 1/8

b. ¼

c ½

d. 1

114. A short bar element of uniform cross-section is subjected to concentrated axial forces at its two ends The longitudinal stress distribution on the cross-section is uniform at

a. All sections

b. The two ends only

c. The mid section only

d. Sections reasonably away from the two ends of the bar

115 Consider the following statements

When two planes at right angles are subjected to direct stresses, the Y axis which denotes shear stresses, will pass through the centre of the Mohr's circle when the direct stresses are

1. Equal in magnitude
2. Unequal in magnitude, in the ratio 1:2
3. Of the same sign.
4. Of opposite signs

Of these statements

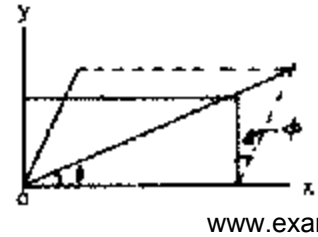
a. 1and 3 are correct

b. 1 and 4 are correct

c. 2 and 3 are correct

d. 2 and 4 are correct

116. In the given figure showing the XY quarter plane, ε_x and ε_y linear strains the directions and ε_n is the linear strain the direction at an inclination of θ from X and Y the shear strain θ is defined as shown. The critical value of θ is given by $\theta \quad \alpha$ where ran 2α is equal to



a. $\frac{\phi}{\varepsilon_x - \varepsilon_y}$

b. $\frac{2\phi}{\varepsilon_x - \varepsilon_y}$

c. $\frac{\phi}{\varepsilon_x + \varepsilon_y}$

d. $\frac{2\phi}{\varepsilon_x + \varepsilon_y}$

117. Match List I (The ones of failure) with List II (Failure envelopes) and select the correct answer by using the codes given below the lists:

List I

A. Maximum Shear Stress Theory

B. Maximum strain Energy Theory

C. Maximum Shear Strain Energy Theory

D. Maximum Principal Strain Theory

List II

1. Rhomboid
2. Ellipse with semi-major and semi-minor axes $\frac{\sigma}{\sqrt{1-v}}$ and $\frac{\sigma}{\sqrt{1+v}}$
3. Ellipse with semi-major and semi-minor axes $\sqrt{2}\sigma$ and $\sqrt{\frac{2}{3}}\sigma$ respectively
4. Hexagonal

	A	B	C	D
a.	1	2	3	4
b.	4	2	3	1
c.	1	3	2	4
d	4	3	2	1

118. The graphical condition for equilibrium of concurrent forces is that

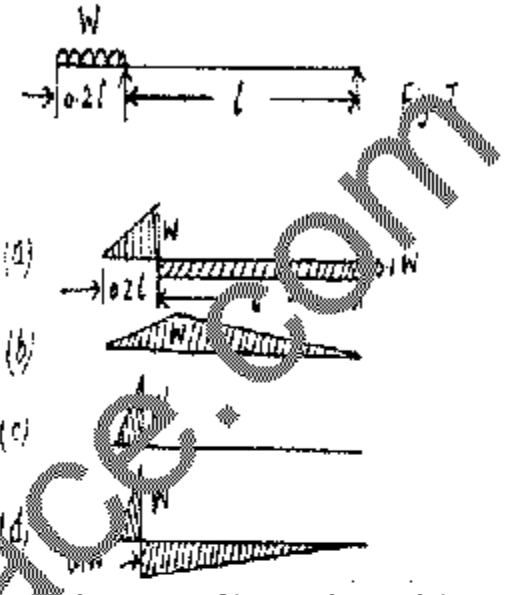
a. Both the forces polygon and the funicular polygon must be closed figures

b. Funicular polygon should be a closed figure

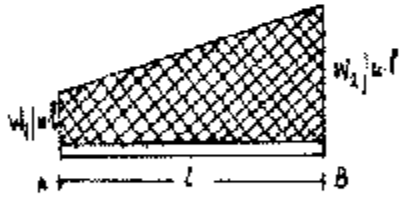
c. Force polygon need not be a closed figure

d. Force polygon should be a closed figure

119. The given figure (Fig. 1) shows a beam cant livening out at one end. It carries a uniformly distributed load W over the cantilever. Which one of the given figures correctly represents the shear force diagram for the beam?



120. A simply supported beam of span 'l' is loaded (as shown in the given figure) with a uniformly varying load of intensity W_1/unit length at 'A' to W_2/ unit length at 'B', the shear force at the support 'B' is given by



a. $\frac{(w_1 + w_2)l}{3}$

b. $\frac{(w_1 - w_2)l}{6}$

c. $\frac{w_1 l}{6} + \frac{w_2 l}{3}$

d. $\frac{w_1 l}{3} \frac{w_2 l}{6}$